SCIENTIFIC AMERICAN

A Weekly Review of Progress in

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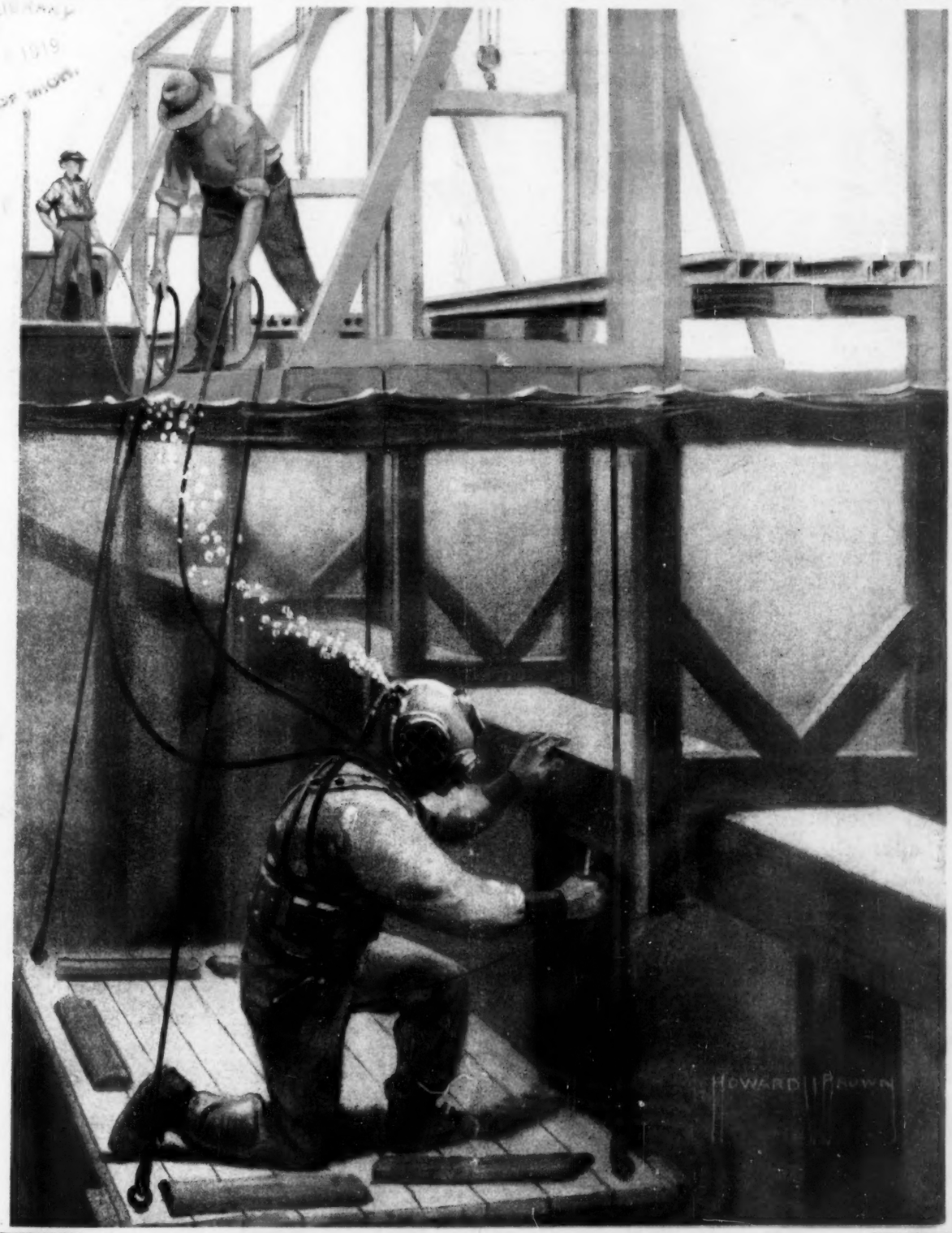

BUILDING THE OUTSHORE SECTION OF A LAUNCHING WAY - (See pages529, 535)

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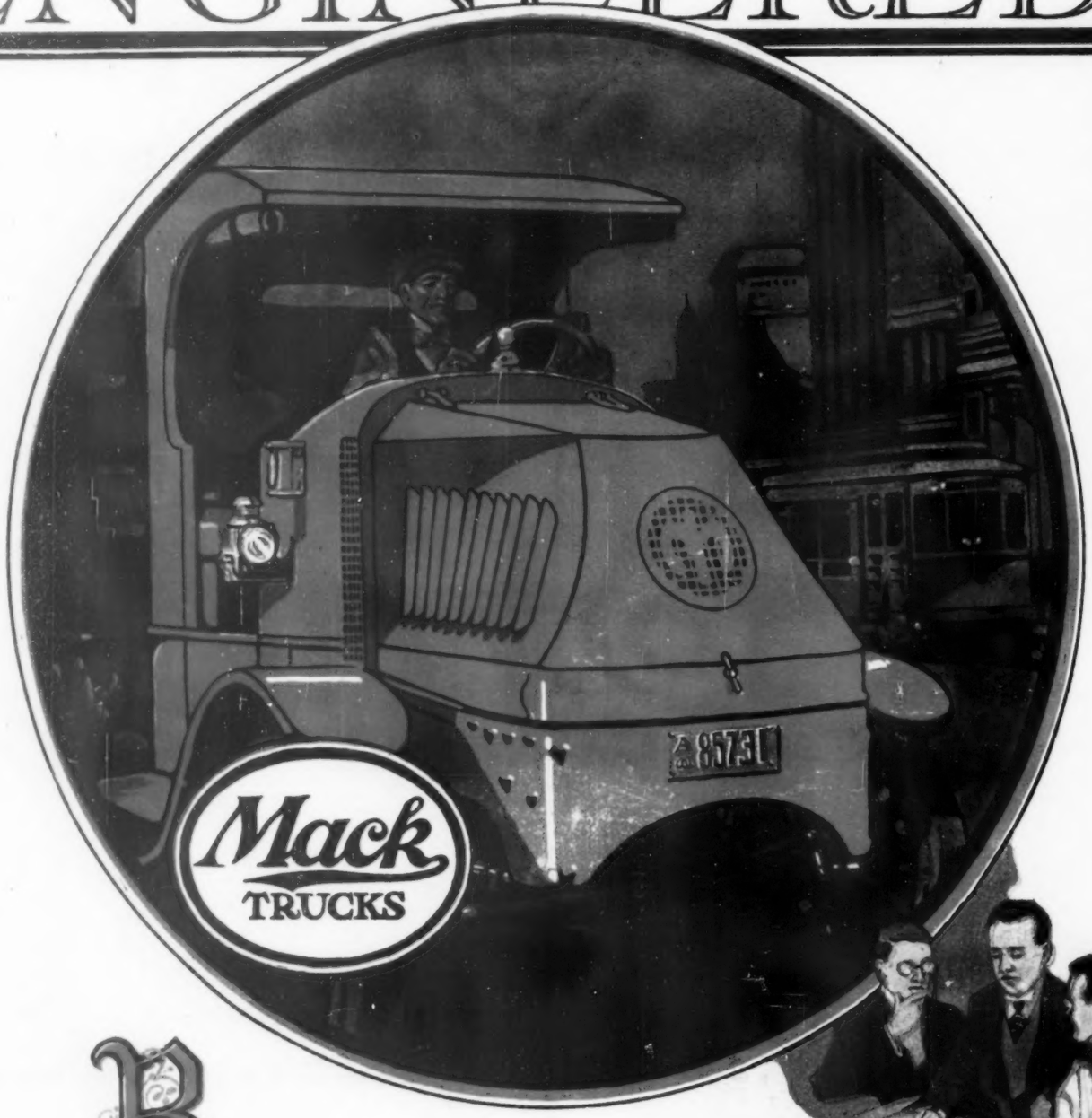
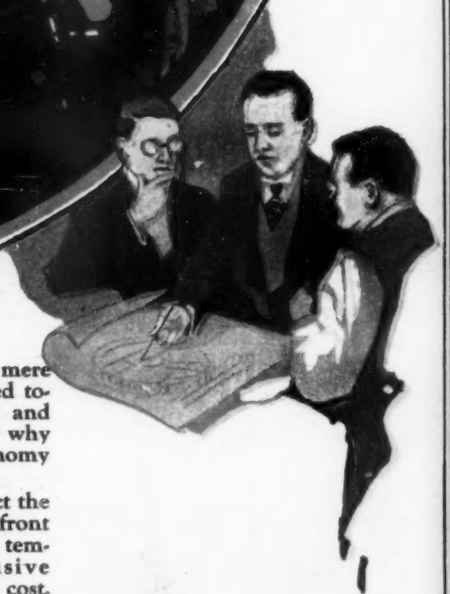
ENGINEERED!





BY "engineered" we mean that MACK trucks are not a mere assembly of parts made in twenty different places and cobbled together. They are *manufactured* trucks—every part designed and made for its special fitness for heavy duty service. That's why MACK trucks are the deliberate choice where trucking economy and delivery performance govern selection.

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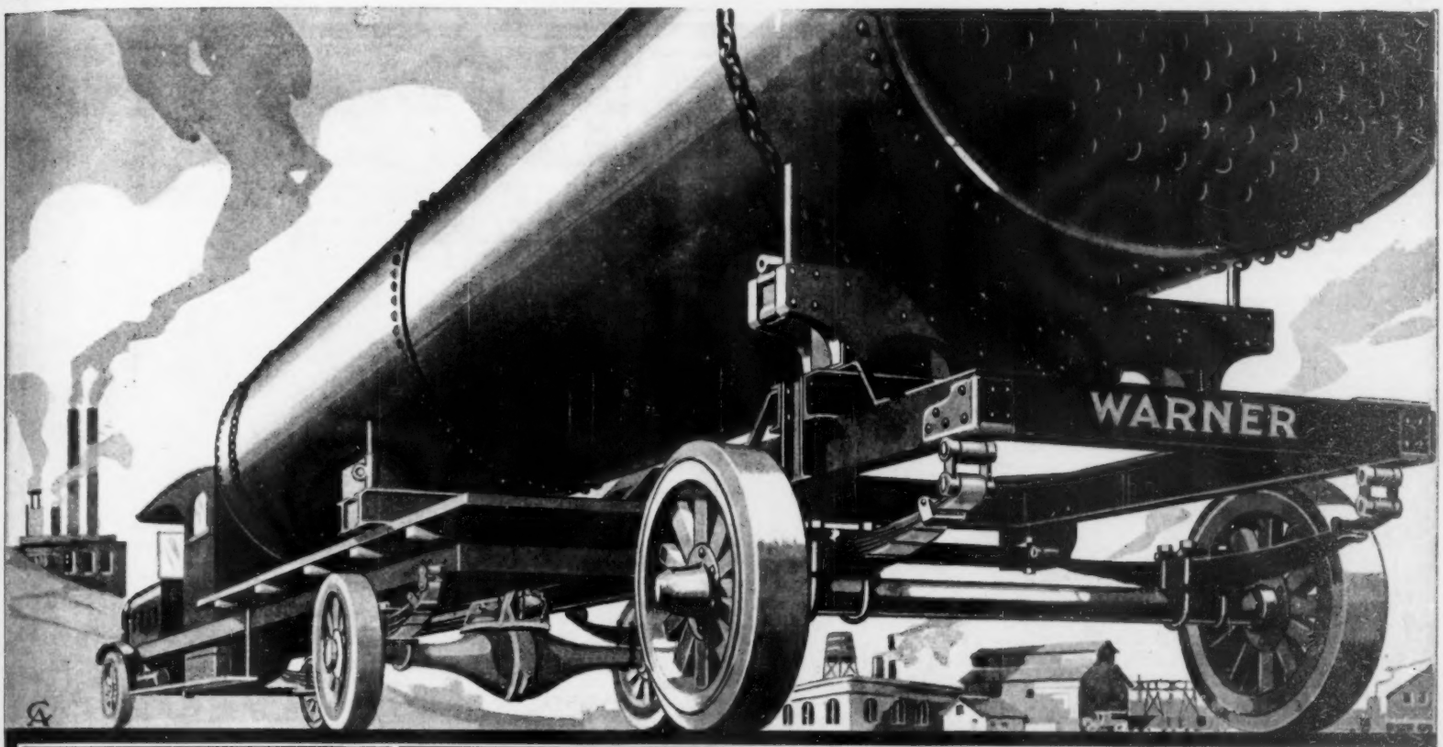
Capacities 1½ to 7½ tons—trailers to 15 tons.

Detailed engineering specifications on request.

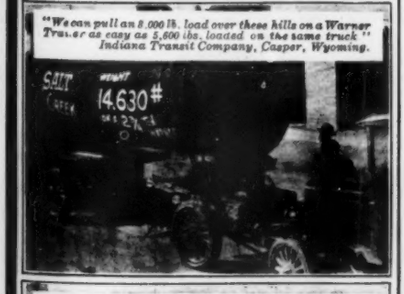
INTERNATIONAL MOTOR COMPANY, New York

"PERFORMANCE COUNTS"



"Our Warner Trailers have been in operation for the past six months and have given satisfactory service."
Curtis Publishing Company, Philadelphia Pa.

"Warner Trailers have given us splendid service and we are very much pleased with them."
Iron County Road Commission, Crystal Falls, Mich.



"We can pull an 8,000 lb. load over these hills on a Warner Trailer as easy as 5,600 lbs. loaded on the same truck"
Indiana Transit Company, Casper, Wyoming.

"Warner Trailers enable us to have delivery capacity of 2 automobiles with upkeep of 1 engine."
Supplee-Willis Jones Milk Co., Philadelphia.

Trailer Sales Increase 125% in New York State

Licenses issued in New York state show an increase of over 125% in trailers from 1917 to 1918. The increase will be even greater this year. Truck owners are finding out what WARNER TRAILERS *really* save.

One driver can do the work of two men. Labor shortage necessitates it. Drivers don't object to picking up a WARNER TRAILER load. There is no excessive strain on the truck. WARNER TRAILERS track perfectly in the path of the truck. Drawbar yoke is hinged to the end of the drawbar and oscillates on the ball of a similar yoke connected to the tie-rod. The wheels are *always* parallel. There is no lost motion. Trailer tires always outwear truck tires.

Relief Springs on all types of Warner Trailers relieve the jerk of starting and stopping or the jolt of uneven going.

The WARNER Ball and Socket Hitch and the one-man coupling device add to the convenience of WARNER 4-WHEEL TRAILERS.

Frequently WARNER TRAILERS cut hauling costs in half. Whether the loads are heavy or the hauls are long, the same consistent ton-mile saving is shown. See what various firms are doing in different lines of business. Consider their experience as a guide to what you can save.

WARNER TRAILERS still further increase motor truck efficiency. The slogan—"*Ship by Truck*"—will soon read "*Ship by Truck-Trailer Trains.*" Savings are astonishing. Man power will be saved. Each WARNER TRAILER will double the work of your truck.

No matter what line of business you are in find out more about Warner Heavy Duty Truck Trailers. There is a size and type for every hauling proposition from the Two-Wheel Warner used in the oil and lumber fields to the Semi-Trailer with Patented Warner Ball and Socket Fifth Wheel and the reliable Heavy Duty Four Wheel types.

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10 Main Street **Beloit, Wisconsin**

WARNER
HEAVY DUTY TRUCK TRAILERS
TWO AND FOUR WHEEL TYPES

SEVENTY-FIFTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

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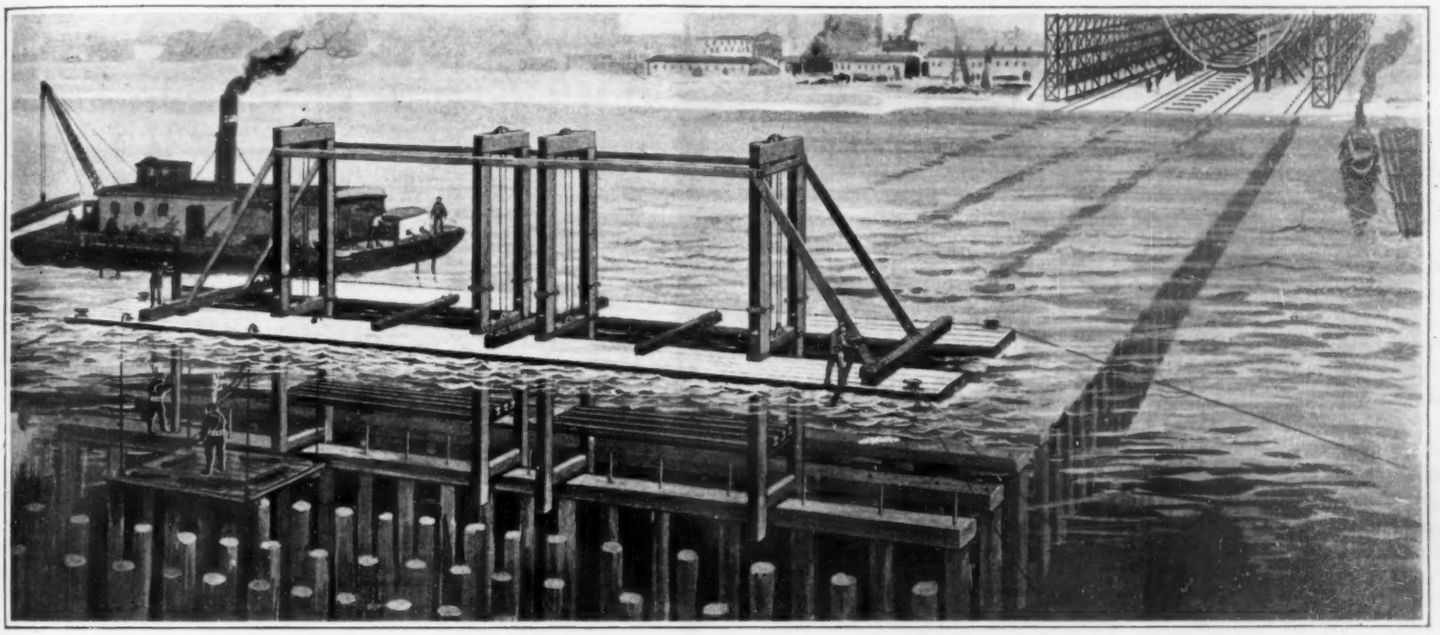
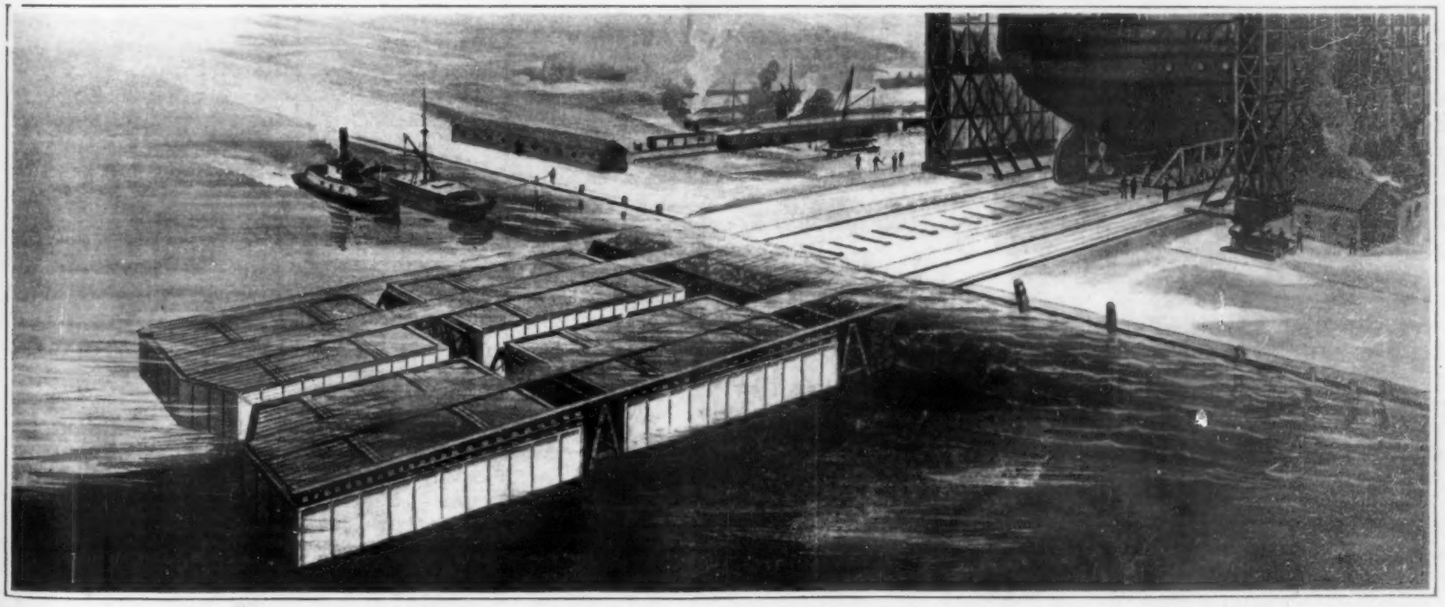


PILE-CAPPING RIG AT WORK ON THE SUBMERGED SECTION OF THE SHIP WAYS: DIVERS BOLTING THE CAP TIMBER TO THE PILES



TEMPORARY LAUNCHING WAYS PROVIDED BY SINKING CONCRETE CAISSONS IN POSITION
AFTER THE SHIP IS LAUNCHED THEY MAY BE REFLOATED AND TOWED OUT OF THE WAY

NOVEL METHODS OF BUILDING LAUNCHING WAYS (See Page 535)

SCIENTIFIC AMERICAN

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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

FICTION AND FACT ABOUT GERMANY

THE oft-repeated statement that Germany does not consider herself to have been beaten and that she is already looking forward to and preparing for the next great war, is the most amazing of the many wild and impossible rumors that fill the air in these days of psychological stress and storm. Ludendorff does not think that way, and surely he ought to know. Those of us who read his book noticed how he reiterated his warning to the civil government that, if the German nation did not stand fast, and if the German government should fail to send the necessary reserves and munitions to the front, the Germans would have to face that complete military annihilation which has now fallen upon them.

If there is one outstanding feature in the German collapse, it is the fact that as a military people they ceased to exist and can not function again for at least a generation to come. German pride was manifest in many directions, but in none so supremely as in that of their great military prowess; and a comparison of the Germany of 1914 and the Germany of today has brought home to that proud nation -- not merely to its military chiefs, but to the simplest peasant who is at all conversant with the facts -- a conviction that, militarily, she is absolutely impotent.

Look at the facts: In 1914 she possessed an army of six million men, exclusive of reserves, backed by the greatest aggregation of military material and supplies the world has ever seen. Today that army is disbanded and its strength reduced to a police force of 100,000 men. Thousands of the pick of her guns have been handed over to the Allies, and her great fleet of military Zeppelins has been or will be similarly handed over or destroyed. In 1914 Germany boasted, and justly so, of her great modern fleet. Today it lies in the mud beneath the waters of Scapa Flow. Her submarines have been surrendered; she may build no more of them; and those she is building must be destroyed. Her future fleet may consist of no more than a few third-class battleships and cruisers. In 1914 Germany's merchant marine, including the largest and most sumptuous passenger liners afloat, had reached out to every corner of the world; and her flag was symbolical of the vast commercial expansion of a great industrial people. Today by way of reparation for her submarine ruthlessness that fleet has been divided up among her enemies, and she is under pledge to build for the Entente many millions of tons until the process of reparation is complete.

So far, then, as the material of war is concerned, in an age when a superabundance is essential to military success, she finds herself stripped absolutely naked. Transportation is indispensable to military operations on a grand scale; yet the German people have seen their best locomotives passing by the thousand, as reparation, into the hands of the enemy, and their freight cars by the hundreds of thousands. No, Germany is not thinking of the next military war. It is our firm conviction that things military come last of all in the list of her preoccupations. The military masters of Germany promised her military supremacy. They have given her military extinction -- and the German people know it.

What then is it that this stricken nation is thinking about and planning for in these days of humiliation? There is every evidence that her thoughts are turned toward one thing, the obvious thing -- the rebuilding and upbuilding of her financial and industrial establishment. Every military asset has been taken from her. She still retains her great, very capable, industrious and well-disciplined man-power; and if those hectic individuals who are running around, trying to make us believe that Germany contemplates a military revival, will but look the plain facts in the face, they will understand that German common sense and practical hard-headedness have shown the German people that there is just one thing to be done with her man power, and that is to go to work seriously, earnestly, and unremittingly, to build up again that great industrial Germany which before the war had won the recognition of the whole world.

There is in the German an inherent love of order, and an inherent capacity for hard work. Moreover, the military system, broken and scattered to the four winds though it is, has left behind an invaluable legacy, in the habits of order and discipline which that system has stamped upon a people that was congenitally ready to receive it. Already we have seen evidence that these qualities are enabling the people to pull themselves together and to address themselves to the herculean task ahead of them. Witness the speedy overthrow of the Spartacus movement and the admirable way in which the new democratic government, with the thunder of the Bolshevistic storm about its ears, has held together and set about the joint task of complying with the terms of the armistice and getting the country back upon its feet.

Germany has lost the military war, but she means to win the economic war if she can. It certainly looks as though labor might win where the soldier has failed; for there can be no denying the fact that, of all the late warring nations, Germany has gone to work in a way that should put some of her late enemies to the blush. Although there have been many strikes in Germany they have been comparatively short-lived, and there is every evidence that labor is bending itself to the task with a fine touch of patriotism.

But what of these United States? We outmatched the German in war; are we now to fall behind him in turning from the arts of war to the arts of peace? Is it possible that the record of the sacrifice of our boys on the bloody fields of France is to be followed by a record of wasteful extravagance and a general lettingdown of effort in the fields of industry and commerce? So great is the world's sorrow that the demand for an increased economic activity is more than economic - it is a moral demand, and, as such, should strike a quickly responsive chord in every American heart. The world's crisis is our crisis and the call for greater output from our farms and factories is the call of humanity. What then shall be said of those professional agitators who are inciting labor to demand, in addition to more pay, which in the majority of cases should be given, reduced hours of work with the resulting reduced output to meet the crying demands of a suffering world? Not by the road of idleness but by that of earnest and well sustained labor is to be found the solution of the present distresses of America and the whole world.

Electricity

UTILITY IRONING SET. -- An American manufacturer of electrical heating appliances has just placed on the market an iron which serves also for light cooking and for heating a curling iron. It consists of a three-pound flat-iron, a folding curling-iron, and collapsible stand for inverting the iron when heating the curling iron or when used as a small cooking stove.

RADIO BARRAGE RECEIVERS. -- Dr. Alexanderson, the well known wireless engineer has developed what he calls a barrage receiver,which permits receiving stations to turn a deaf ear to all other messages except the particular one which they desire to hear. In a recent lecture Dr. Alexanderson outlined a comprehensive plan for a world-wide system of radio communication, which, he believes, will send messages at the rate of 100 words per minute.

POWER FROM THE WAVES. --- Practical experiments to determine the possibility of utilizing tidal power to make good for the coal shortage under which France is expected to suffer for a long time, will be carried out under Government auspices in St. Briac, on the north coast of Brittany. A committee has been appointed for the scientific investigation and study of hydroelectric power, and will undertake the experimentation by Government order, continues Electrical Review. Experiments are also being conducted to determine the possibility of replacing coal partly by gasoline.

TRANSATLANTIC WIRELESS TELEPHONY.-- Speaking recently before a gathering of students at University College, London, Prof. J. A. Fleming brought out some interesting facts regarding transatlantic wireless telephony. He mentioned the Marconi experiments between Ballybunion, Ireland, and Nova Scotia, a distance of 1800 miles. The object was to determine the current necessary in practical working, and thus differed markedly from the performance of telephoning between the United States and Paris. For this reason, signaling was carried on for 10 or 12 days during the daytime: that is, when interference is more serious. A 3½-horse-power alternator was employed, the aerial being 500 feet high, and the wave length 4,000 meters. The current in the aerial was 16 amperes. It was found that the speech, which was received by the usual commercial amplifying apparatus, was quite good enough for easy reception.

Science

SMITHSONIAN METEOROLOGICAL TABLES.- The fourth revised edition of these well known tables has been published by the Smithsonian Institution. The previous edition had been out of print for some years, and this fact constituted a serious handicap, during the war, to the meteorological services of the Army and Navy, the Air Service, etc.

THE MILNE SEISMOLOGICAL OBSERVATORY at Shide, in the Isle of Wight, once a Mecca of seismologists, no longer exists. Dr. Milne bequeathed the equipment of the observatory, including the library, to the seismological committee of the British Association. After his death the observatory was, at first, maintained in operation at Shide, but it has now been transferred to Oxford, where the work will be continued under the direction of Prof. H. H. Turner.

MAP WORK IN THE WEST INDIES. --- In view of the paucity of detailed maps of many parts of the West Indies, it is interesting to learn that the U. S. Geolpgical Survey has undertaken an extensive topographic mapping in that region. The governments of Haiti and Santo Domingo have made appropriations for the execution of complete surveys of their countries, and have asked the Geological Survey to take charge of the work, and provide the technical equipment. Porto Rico and Cuba will probably take similar action. A Division of West Indian Surveys has been established by the Geological Survey, and placed under the charge of Lieut.Col. G. S. Smith. Field work in the Dominican Republic is already in progress. It is expected that the survey of that country will be completed within four years.

SPITSBERGEN AS A HEALTH RESORT. - It is announced that a British concern which has acquired an extensive concession in Spitsbergen, plans to establish a large sanatorium in that Ultima Thule of Europe. It will be especially designed for consumptives but the air is said to have a bracing quality, making it favorable for other classes of invalids. Presumably the sanatorium will be inhabited only during the summer months. A warm marine current gives to the west coast of Spitsbergen a remarkably mild climate for its latitude. At Green Harbor, where a Norwegian meteorological observatory has been in operation for some years, providing daily reports by wireless to the weather services of Europe, the average maximum summer temperature is 52° Fahrenheit.

Aeronautical

FRENCH SPEED TESTS.-- M. Sadi Lecointe, in a recent series of speed tests at the Villacoublay airdrome, made a mean speed of 184 miles in an improved Spad-Herbemont biplane, and on a two-seater with his mechanic as passenger at 175 miles an hour.

BRITISH R-80 DIRIGIBLE.-- The airship R-80, which the Vickers organization had completed to the extent of 95 per cent for the British government, and on which work was suspended, is to be completed. Lighter and more commodious cars are a feature of the R-80. The engines are of the British-made Maybach, which have given extremely satisfactory results under trial. This type is, so far, undoubtedly the best airship engine in existence.

BRITISH ABANDONMENT OF AIRSHIPS.--- The decision of the British Government to cease work on rigid airships has caused surprise, increased somewhat by the news that airships, airship stations, stores, etc., are to be placed, on agreed terms, at the disposal of persons interested commercially in the construction of airships, with the idea that they follow up the commercial development of this type of airship. While it is believed that nothing can stop this development, and that many firms might even attempt to inaugurate air mail service to America, the withdrawal of such State assistance and support as rigid airship building has hitherto received might make it difficult for private enterprise to cope with the cost without a subsidy.

WIRELESS-CONTROLLED PLANES.-- When recently interviewed at Amsterdam, M. Fokker, the Dutchman who figured so prominently in German wartime aviation, stated that in 1916 the German army authorities asked him to make a cheap airplane capable of flying about four hours, to be steered by wireless and to carry a huge bomb. It was intended to send these machines aloft in groups, to be controlled by one flying man. They had lost faith in big guns. Fokker says he prepared the plans but the German War Office decided to make the machines in government factories, with the result that they bungled along for months. Then, in the summer of 1918, they gave a huge order for wireless-controlled airplanes to M. Fokker, and he was just ready to manufacture them in wholesale quantities when the armistice was signed.

WHARFHOUSE AND COTTON WAREHOUSES JUST ERECTED AT NEW ORLEANS, SEEN FROM ROOF OF PUBLIC GRAIN ELEVATOR
THE WOODEN BUILDINGS IN THE FOREGROUND ARE THE BARRACKS USED BY THE RIVER GUARD DURING THE WAR

CONCRETE CONSTRUCTION ON THE MISSISSIPPI SANDS

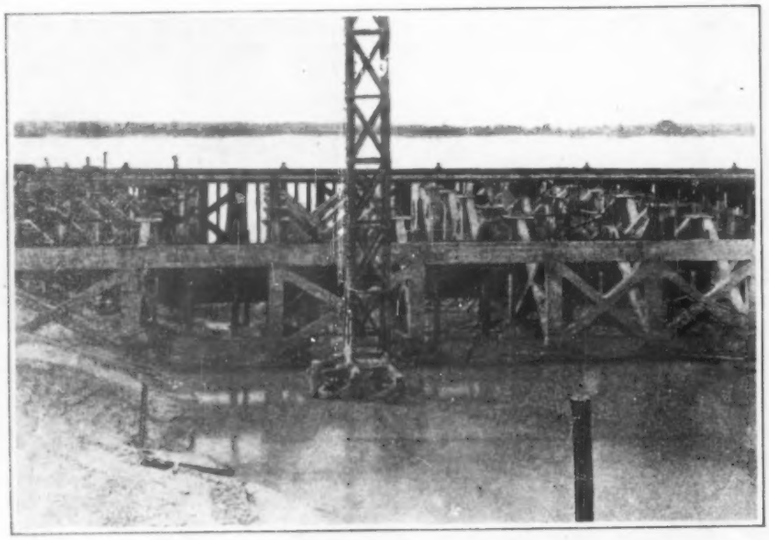
THE BUILDING OF THE PUBLIC COTTON WAREHOUSE AT NEW ORLEANS

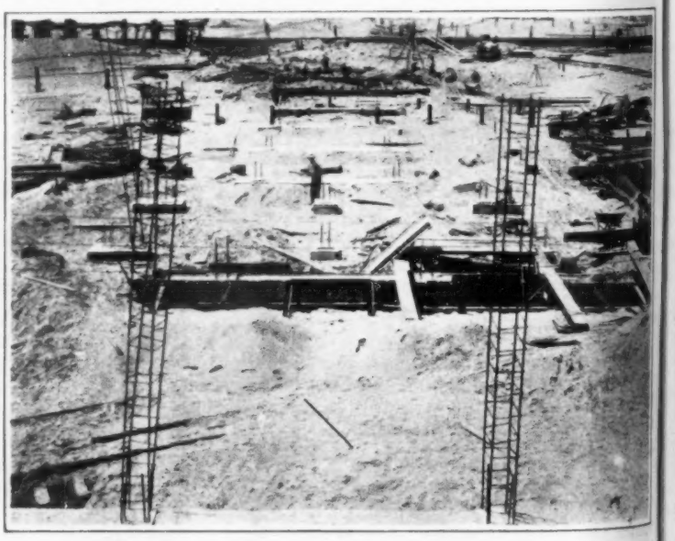
BY ROZEL GOTTHOLD

COTTON that comes to New Orleans is handled under three classes: the consigned or factor's cotton; the f.c.b. cotton; and the through cotton. Consigned cotton is cotton shipped to a factor in New Orleans, to be stored until sold for the owner's account. F.c.b. cotton is that which has been accumulated at interior points and sold on sample, subject to examination at New Orleans. Through cotton is by far the greatest in amount; it has been sold in the country to the buyer for direct export, and is shipped on a through bill of lading, combining both rail and water rates.

Until the public warehouse was ready for use, in 1915, the handling of cotton was slow and expensive. It was hauled by drays to the old cotton yards, which looked very picturesque down along the old river-front streets, but which certainly did not make for the efficiency of the port as a market for the commodity.

The great idea in New Orleans, for the past fifty years, has been to make of the city a deposit market for the cotton supply of the world; and when, in 1914, the Legislature of the State of Louisiana authorized the Board of Commissioners of the Port of New Orleans to issue and put on the market bonds amounting to over $3,000,000 for the erection of a great cotton warehouse, that dream was at the beginning of reality. In July 1914 a contract was let for the filling of a site on the river bank, with 2,000,000 cubic yards of sand to be dredged from the Mississippi, at a cost of $180,000. This made land, with that which was already there, approximated 100 acres. Here began to arise the structure of concrete and steel which is proving the magnet that draws to New Orleans cotton from as far west as California





THE NEW ORLEANS PORT IMPROVEMENT

Left: The concrete piling of the wharfhouse and the creosoted pine piling for the wharf apron. Right: The center crossing, showing the concrete foundation of the wharfhouse

and as far east as Georgia.

The business dore by the warehouse is limited only by its capacity. During the past season it had to refuse much of the business of fered it, because of lack of space. It has grown much faster than was believed possible so today there are in course of erection two new units each having a capacity of 85,000 bales; this, with the six now or the ground, will give to the warehouse a storage capacity of more than 500,000 bales, and the means to handle an annual business of 2,000,000 bales.

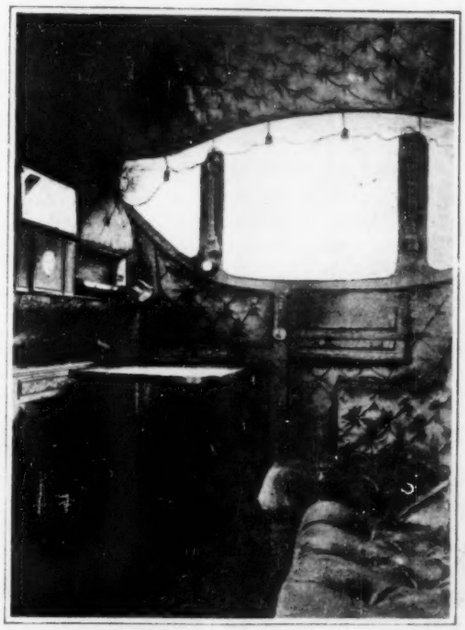
INTERIOR OF THE PUBLIC COTTON WHARFHOUSE AT NEW ORLEANS

The warehouses are built to handle all three classes of cotton, with equal efficiency. The handling of through cotton is not as big with the warehouse as is the manipulation of consigned and f. o. b. cotton, as the idea of coming thus far upstream is new to many of the ocean steamers which usually land at the old docks below Canal Street in the lower section of the city.

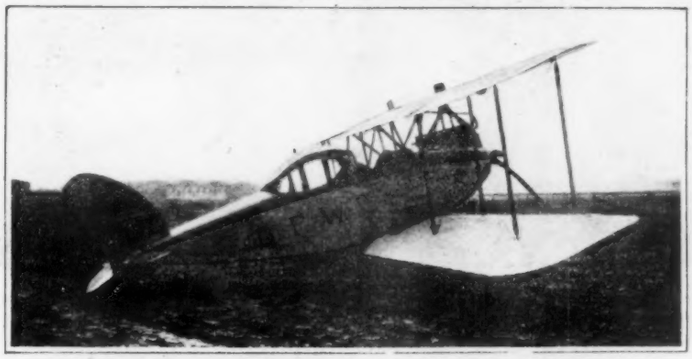
The consigned cotton which comes to the warehouse from interior points in an uncompressed or flat state is compressed upon arrival, and stored for the first month at 35 cents per bale. The plant is equipped with three high-density compresses, with another to be added immediately.

The f.o.b.cotton is sent to New Orleans subject to examination. It must be classed, weighed, etc., upon arrival; for this the warehouse charges 25 cents per bale. This class of cotton must be handled within 12 hours of unloading, otherwise additional charges are made. Before the warehouse was in use, the railroads bringing in this class of cotton used to store it in their terminal sheds, giving it ten days of free storage, so that the buyer could examine it. In the handling of through cotton, only the compressing will be charged for, no receiving or storing or marking charges being made.

The entire construction of the warehouse, except the wharf apron, is of the reinforced concrete. The warehouses are one story high, the wharf two stories. The buildings are supported on creosoted pine piles, from 35 to 50 feet long, according to the weight carried. Running across the site, between each group of two units, are railroad tracks, which allow the direct handling of cotton from car to ship or vice versa.



THE CABIN IN WHICH AERIAL LUXURY IS CARRIED TO A CLIMAX



GENERAL VIEW OF THE AIRPLANE DE LUXE

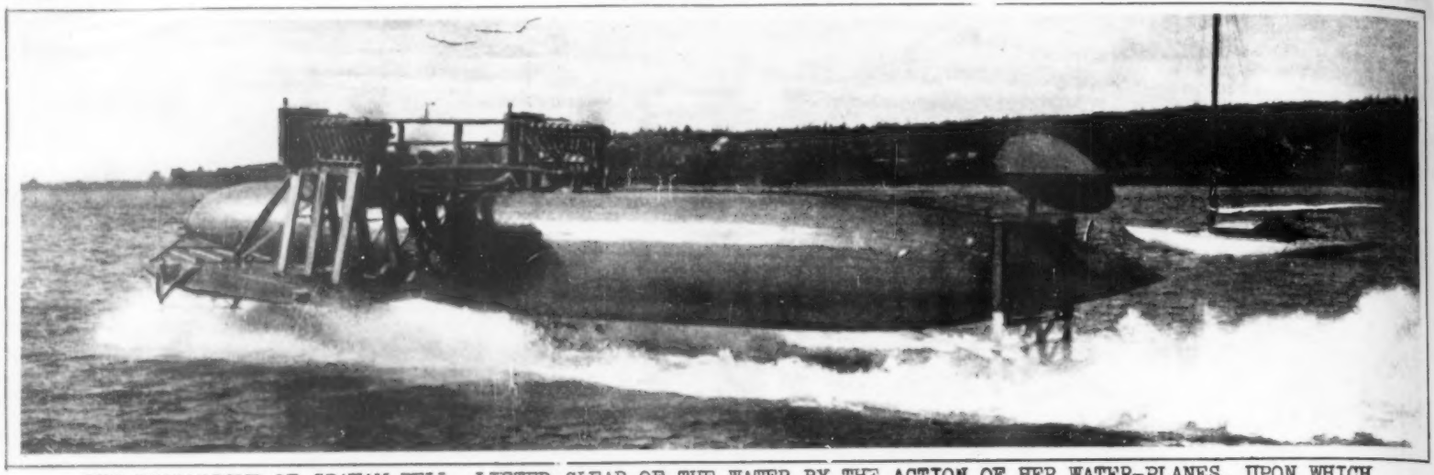
The wharfhouse construction is exceedingly interesting. It is of a later date than the rest of the building, and embodies the newest developments of such construction found successful in other ports, with such changes as are necessary for the conditions at New Orleans. A series of baffles, of creosoted pine planks, was laid in the sand-pack or fill before the concrete construction was begun. By means of this arrangement, the sand is held firmly together. It is a system of terraces which extends far out into the river at the front of the wharf apron. Here, at a depth of sixty feet divers placed the baffles, which go back to the rear of the wharfhouse, rising in a terrace with the slope of the land.

On a visit to the warehouse, the writer found a new unit in course of building next the wharfhouse. The

(Continued or page 546)

AERIAL LUXURY

No machine attracted more attention at the aeronautical exposition recently held in Amsterdam, Holland, than the aerial limousine shown in the accompanying illustrations. This machine, which is of German design and construction, is in every sense of the word a winged limousine. The cabin is upholstered throughout in red Russian leather, and is fitted with every convenience and refinement making for absolute comfort in flight. It contains a working desk, a clock which strikes the hours and half-hours, mirrors, electric lights, chair, roomy lounge that can be converted into a bed, telephone system for communicating with the pilot ahead, straps or cords for steadying oneself, and so on. The pilot sits forward in an individual cockpit. As far as the aerodynamic design is concerned this machine follows the lines of the battle planes employed by the Germans toward the end of the war. A 6-cylinder engine of perhaps 250 H.P. is used, with a rather thick stream-lined body.



THE HYDRODROME OF GRAHAM BELL, LIFTED CLEAR OF THE WATER BY THE ACTION OF HER WATER-PLANES, UPON WHICH SHE IS GLIDING AT 70 MILES PER HOUR

A SEVENTY-MILE HYDRODROME

A NEW GLIDER WITH RECORD SPEED DEVELOPED AT DR. GRAHAM BELL'S LABORATORIES

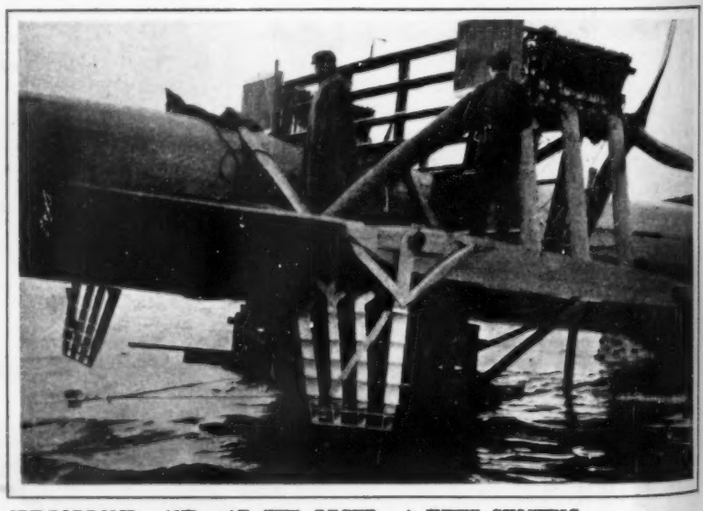
TEXT AND PHOTOGRAPHS BY WILLIAM WASHBURN NUTTING

OF the many important things that have been developed at Dr. Alexander Graham Bell's laboratories, probably the most interesting is an odd-looking glider that has recently been startling the natives of Baddeck, even accustomed as they are to strange sights, by skimming blithely about the wonderful Bras d'Or Lake at the rate of 60 knots, which is in the neighborhood of 70 miles per hour. The new glider is the result of a series of experiments conducted by Dr. Bell and Mr. F. W. Baldwin during the last ten years. She is not a seaplane, neither is she a hydroplane in the usual sense of the word. "Hydrodrome" is the name that has been given this type of craft at the laboratories; and the present model is the fourth - hence her name, HD-4.

The HD-4 is the successful development of the idea, by no means new, of dodging the resistance of the water by lifting the hull clear of it, through a system of planes not a part of the hull itself. In other words, the hydrodrome utilizes the denser medium to obtain the lift, while taking advantage of the comparatively low resistance to propulsion offered by the air. An ordinary surface hydroplane, while it utilizes the lifting principle and in this way avoids much of the resistance of the water, is still comparatively inefficient in that it uses only the lower and by far the less efficient face of the plane.

The idea is an alluring one; and many have been the attempts to work out such a craft on paper -- as the patent office records will show. Eight or nine years ago, about the time that Mr. Bell and Mr.. Baldwin built their first machine, Cooper Hewitt experimented with a glider employing the same general idea of superposed planes; and Forlanini attained some success with a boat of this kind in Italy. Since that time the hydrodrome has undergone a great development, although as Mr. Baldwin points out, it is still in the same stage as the airplane ten years ago.

The photographs show that when the machine is at speed the hull is clear of the water, supported on small shutter-like planes. These are of steel, and are graduated in size - large at the top, to very small at the bottom. The greater the speed, the higher the hull rises out of the water, automatically reducing the lifting surfaces to the amount needed to support the load. These planes



DR. ALEXANDER GRAHAM BELL IN THE COCKPIT OF THE HYDRODROME; AND, AT THE RIGHT, A VIEW SHOWING THE PORT AND STARBOARD HYDROFOIL SETS, WITH SEVEN SURFACES IN EACH. AS THE SPEED INCREASES, THE HYDROFOILS RISE, PROPORTIONATELY, CLEAR OF THE WATER

are unbelievably small until one remembers that the supporting surface required to carry a given load is in inverse proportion to the density of the medium in which it acts. The specific gravity of salt water is nearly 800 times that of air, so the hydrodrome requires hydrofoils but 1/800 as large as the aerofoils of an airplane carrying the same load.

An important feature of the HD-4 is the automatic reefing of the supporting surfaces, which, I believe, never has been attempted on aircraft, for which there is yet but one economical condition of speed and load. Any divergence from this condition is inefficient, and no method has been devised by which the area of the planes may be changed to suit variations of speed or load. The lack of such a device is particularly felt when the airplane takes off or lands.

Now the under side of the airplane wing is by no means as important as the upper. All tests show that never, even with flat planes, does the lower surface exert any more than one-quarter of the total lift. It is the camber of the upper surface over which a partial vacuum is created that does the trick. What is true of one medium is more or less of another; and therefore it would seem that a boat using only the effect of the water impinging on the sloping surfaces of the planes to obtain the lift, is not the ultimate solution of the problem of ob-

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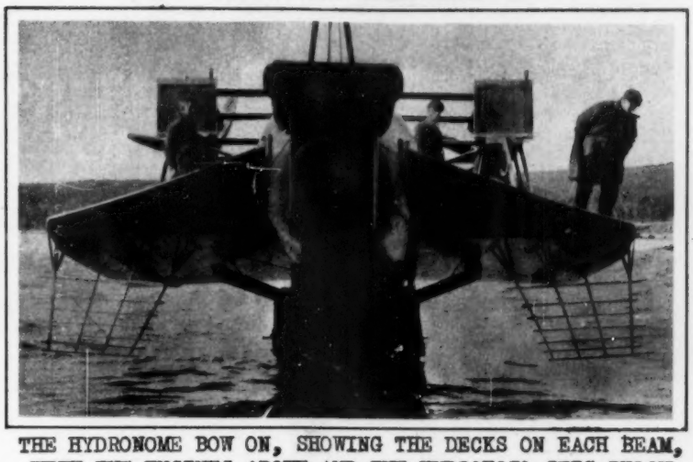
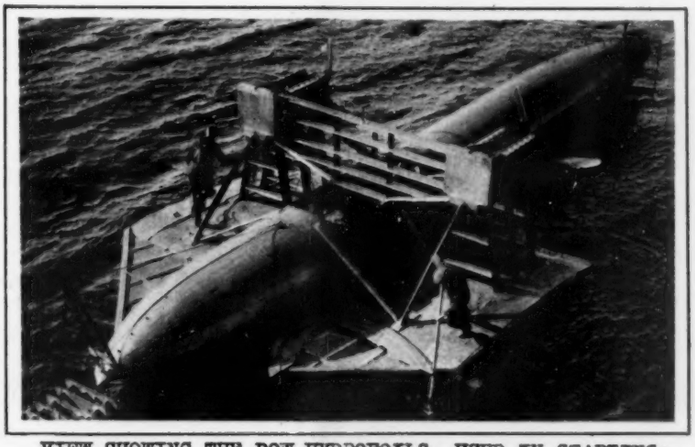


THE HYDRONOME BOW ON, SHOWING THE DECKS ON EACH BEAM, WITH THE ENGINES ABOVE AND THE HYDROFOIL SETS BELOW

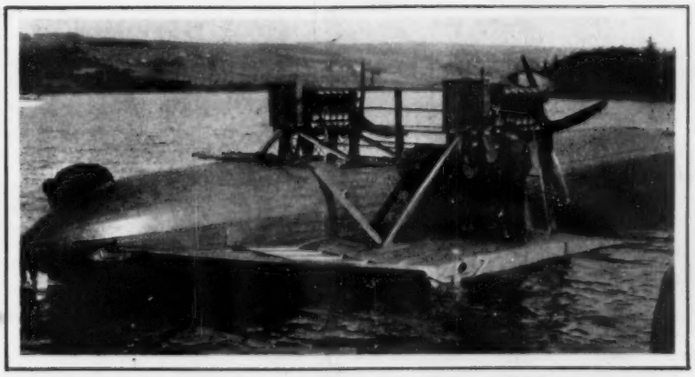


VIEW SHOWING THE BOW HYDROFOILS, USED IN STARTING; AND THE TWO 350-H.-P. LIBERTY MOTORS, WITH THEIR METHOD OF ATTACHMENT TO THE DECKS AND EACH OTHER BY STREAM-LINED BRACING

NOVEL METHODS OF BUILDING LAUNCHING WAYS

THE time-honored method of building the outshore sections of launching ways is to construct a coffer-dam around the site and then to pump out the water to lay the bottom bare. In the war emergency a Bristol, Pa., contractor chose to do the work without unwatering the site. He saved some time, and fifty per cent of the cost. The methods he used are shown on our cover, and in the upper illustration of our opening page.

The first work was to drive a foundation of piles for the outshore part. Concrete mattresses were used for the shore part and near the water's edge concrete piles were used, supporting concrete caps. The submerged portion, however, was built on wooden piles. The first few rows were cut off and capped at low water, but the rest had to be sawed off under water by means of a circular saw driven by an electric motor and suspended from a floating pile-driver.



THE DECKS WHICH CARRY THE MOTORS ABOVE AND THE HYDROFOILS BELOW ARE CLEAR OF THE WATER AT SPEED

After the piles were cut came the task of alining them in rows. Divers were employed for this. By means of yellow pone stay-lathes and special clamping screws they drew the piles into alinement to receive the caps. These were 12x14-inch timbers which had to be framed to bear evenly on the head of each pile. To carry out this work, a special pile-capping machine was built as shown in the drawings. This consisted of a double raft, between the sections of which the cap timbers were lowered. To force them down, spuds weighted with railroad iron were used. These were arranged to slide in frames carried by the raft. To support the divers at the proper elevation wooden platforms were suspended from the raft and weighted with pig iron.

A timber cap was floated between the two platforms of the raft, and the spuds were then lowered to force it down upon a row of piles. Divers scribed the cap at each pile and indicated irregularities of elevation. Then the cap was refloated and taken ashore, where it was cut away or built up to bear uniformly on each pile. Bolt holes were bored and drift-bolts driven through the cap, after which the timber was sunk a second time on the row of piles under the guidance of divers and the drift-bolts were driven into the piles. The timber decking was assembled on shore in sections of convenient size. These were lowered into place and spiked to the caps with the aid of divers.

The second drawing on our opening page illustrates another unique construction for launching employed in a British ship-yard. Here on account of the narrow waterway a permanent underwater constructoon would have obstructed navigation; so it was determined to use an outshore structure which could be assembled for use, and then drawn away, clearing the stream for shipping. Four large concrete caissons were built and a foundation prepared for them so that they coule be towed to position and sunk in place. On these caissons the ways could readily be laid when needed.

SHAMROCK IV

THE LATEST BRITISH YACHT TO TRY FOR THE AMERICA'S CUP

THE removal of "Shamrock IV" from South Brooklyn to the shipyard of Robert Jacob at City Island afforded an opportunity for the yachting "sharps" to look at that part of Sir Thomas Lipton's latest challenger which lies below the water line. For immediately upon reaching City Island, the boat was hauled out upon the marine railway and exposed to view.

"Shamrock IV", as she emerged from the water created somewhat of a sensation, for she is certainly quite unlike any previous cup challenger. She is the lightest and, at the same time, the most powerful British yacht for her length that has come here to compete for America's cup.

The most striking feature of the boat is the extraordinary length of her keel, which measures along the bottom just 35 feet. Another interesting fact resulting from the last-named is that the average vertical thickness of her lead cannot be over two feet. Moreover, the width of the lead is something over three feet at its widest part. This means, of course, that, as compared with "Resolute", the bottom length of whose keel is less than half that of the "Shamrock IV", or, to be exact, fifteen feet, the center of gravity of "Shamrock's" sixty tons of lead must lie very much lower than that of "Resolute" or "Vanitie", the keel length of the "Vanitie" being about twenty-two feet. Lower lead means greater sail-carrying capacity for the same weight.

It is this,, probably, that lead Nicholson, her designer, to be willing to incur the great increase of wetted surface due to the larger lateral plane involved in the abnormally long keel, for while the element of low-placed lead and great sail area will increase her speed in fresh breezes and at the lower speeds, where the wetted surface and its skin friction are such important considerations, the Lipton boat will be at a great disadvantage.

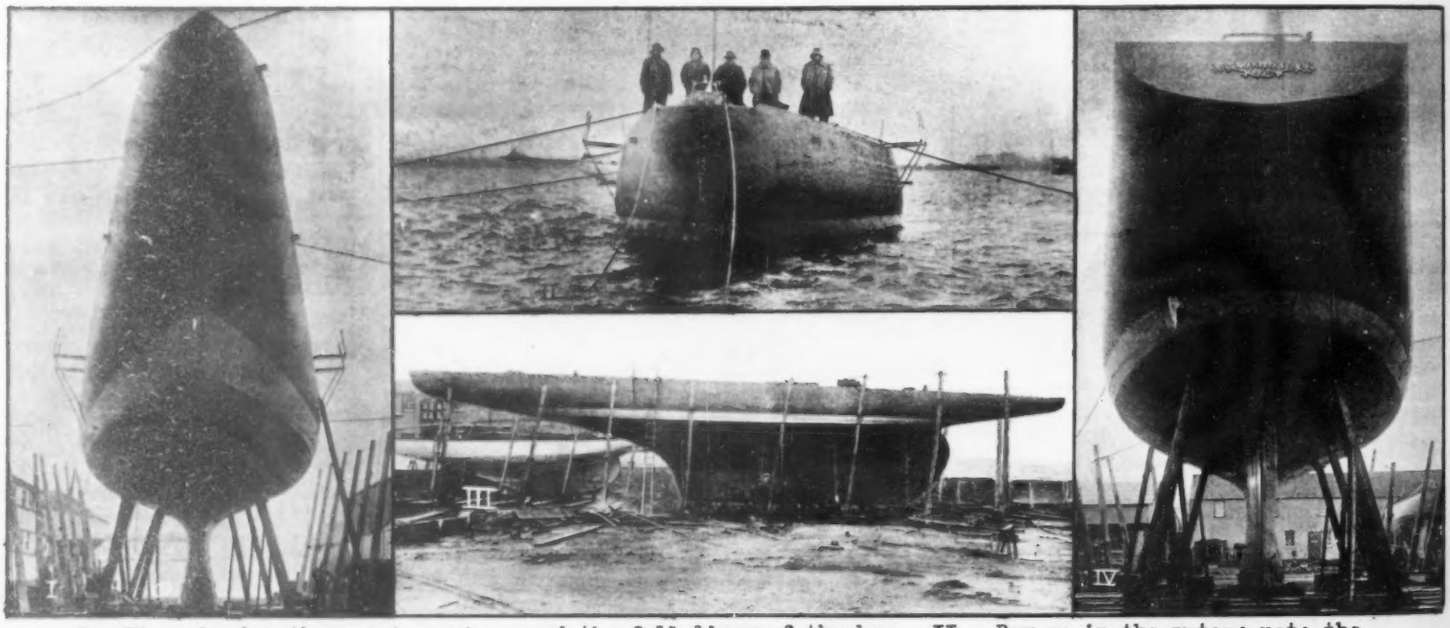
Next to her low lead and long keel the outstanding feature of the boat is the full bilges and the way in which fulness is run out into the bow and stern sections. This is clearly noticeable in several of the accompanying photographs.

Another feature, never before seen either in challenger or defender in the American cup races, is the sharp tumble-home of the topsides. In fact, it must be thirty years or more since this was last incorporated in a yacht's model. The rig also is most unusual for a yacht of this size. The mast is set very far forward -- so far, indeed, that in order to get sufficient spread for the shrouds the designer has had to build outrigger chain-plates. The bowsprit is very short -- just a "stump" -- and a single fore-sail is used. The rig is exceedingly lofty, so that the sail-plan will reveal great height on a comparatively narrow base. This is in accordance with the best modern practice.

The hull is of very light composite construction, the planking being three-ply, with two inner layers placed diagonally and the outer layer, of course, longitudinally. The deck also is almost absurdly light, consisting of several piles of birch veneer.

Altogether, the "Shamrock" is an engineer's boat, and although she may be looked upon as a daring design, it is evident upon close inspection that she has been built strictly to the "strain sheet", if we may borrow a term from the bridge engineer.

If, on the day of the races, there should be one of our spanking northwest, off-shore breezes blowing, with a smooth sea so as to put the yachts about rail down --- that should be Shamrock's day; but if she meets the light airs that have prevailed at past cup races she is lost.



I - View showing the great overhang and the full lines of the bow. II - Bow on in the water; note the outrigger chainplates. III - Broadside view, showing great length of keel and the large lateral plane. IV - Stern view, showing the approximate midship section and the bulb keel

REPRESENTATIVE VIEWS OF "SHAMROCK IV"

The Heavens in December, 1919

VERIFICATION OF THE EINSTEIN THEORY OF RELATIVITY FROM THE ECLIPSE PHOTOGRAPHS

By Professor Henry Norris Russell, Ph.D.

There are several items of astronomical interest this month. Foremost of course, is the report which comes from England, of the successful outcome of the observations made during the eclipse of last May to determine whether rays of light passing close to the sun are deflected from their course. This report affords one of the rare instances in which a topic of pure science assumes sufficient journalistic importance to justify cable despatches a column long; and in this case at least the real importance of the discovery is commensurate with the popular attention which is devoted to it.

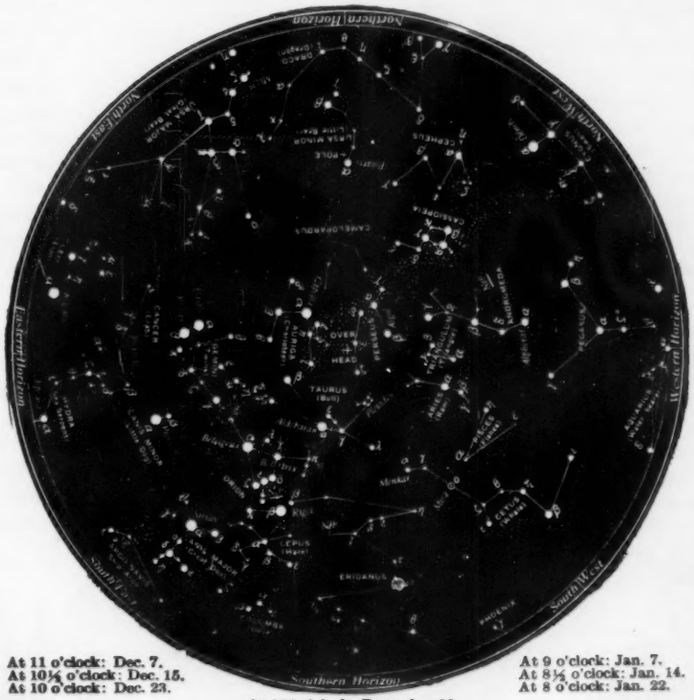
The observed facts are easy enough to understand. At the time of the eclipse, the sun stood in a region of the heavens which is rich in bright stars -- the Hyades, the well known cluster near the bright star, Aldebaran. When the sun's disk was obscured by the moon, these stars became visible, and could be photographed - the duration of totality being long enough to permit of several successive exposures. On the plates so obtained, the apparent positions of the stars could be accurately measured, and compared with those on other plates of the same regions taken when the stars were visible at night, remote from the sun. The comparison showed beyond question that those stars whose images fell near the occulted sun were apparently shifted in position, in comparison with the remoter stars in the field, which served as standards of reference - the shift being, in all cases, away from the sun's center.

This taking and measuring of photographs of the stars is an everyday matter in observatories and the precautions necessary to insure accuracy are well known. The astronomers who are responsible for the present investigation -- Prof. Eddington of Cambridge and Dr. Crommelin of Greenwich Observatory -- are thoroughly familiar with work of this sort, and have undoubtedly taken every precaution to insure accuracy. Their conclusion that the shift of the star image actually occurs is accordingly unchallengeable.

EINSTEIN'S THEORY OF RELATIVITY

What this discovery means is, obviously, that rays of light which pass near the sun are deflected towards it -- so that looking back along the deflected ray toward the star, the latter appears to be shifted away from the sun. Crudely put, it is evident that the sun, and presumably any other large body, attracts passing waves of light and deviates their paths. The deviation is small, only $1\frac{3}{4}$ seconds of arc for a ray which has passed close to the sun; but it is twice as great as the deflection which would br produced according to the familiar theory by the sun's attraction on the motion of a material particle moving past it with the velocity of light.

The most remarkable feature of the situation is that this deflection, both in direction and amount, had been predicted theoretically by Einstein, a physicist of Swiss birth, resident in Germany, who has long been recognized by students of mathematical physics to be worthy of the high place which will doubtless now be his by acclamation.



NIGHT SKY: DECEMBER AND JANUARY

His theoretical discussions are far too complicated to speak of here: indeed, the mathematical developments are of so unfamiliar a nature, that very few living men are competent to analyze them critically. But it may be possible to give some idea of the nature of the concepts which led to the development of his theory.

WHAT IT ALL MEANS

The theory of Relativity, which has excited the lively interest of physicists for some years past, and now appears to be firmly founded in fact, is based on the hypothesis that Nature is so constituted that it is impossible, by any physical experiment, to distinguish whether a given "system," including the observers, their instruments, and everything they can detect and observe, is at rest in space; or whether all parts of it are moving in the same direction and at the same rate. In both cases, the relative motions of the various parts of the system will be the same; and if the theory is true, only these can be the objects of physical investigation.

Einstein, starting with this hypothesis, considered a further question, which may be illustrated as follows. Assume an observer, who, with all his instruments, is enclosed within a large, perfectly tight box, inside which he can live and work indefinitely. Now imagine, first, that the box and its contents are at rest in space (except in so far as he, in his experiments, sets various contained objects in relative motion). Second, suppose that the box and everything inside it are all falling freely in a uniform gravitational field (as bodies do near the earth's surface). Since the box and its contents are all falling at the same rate, the observer will not feel the pull of gravity, nor can he detect its existence by any experiment involving the motions of material bodies. But, according to the theory of light which was accepted until recently, the presence of the gravitational forces will not affect

(Continued on page 540)

Inventions New and Interesting

A Department Devoted to Pioneer Work in the Arts

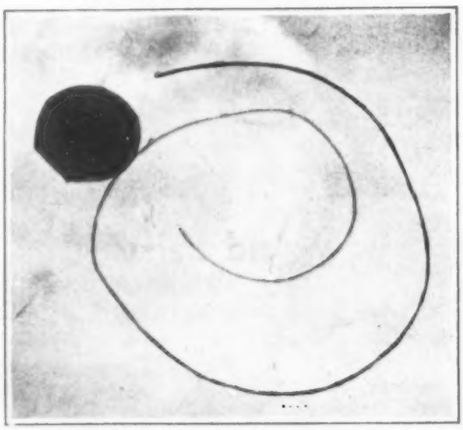
AN EXTRA HAND WHILE TELEPHONING

THERE are times when one or two extra hands would come in very handy, but none so much as when telephoning and trying to jot down facts and figures. Numerous devices have been developed to free both hands while telephoning, and one of the latest appears in the accompanying illustration. It consists of an adjustable arm for holding the receiver to the ear in the manner depicted. The receiver is left permenantly in the clamp, so as to be ready for instant use. When the telephone is not in use, the arm is turned away and back from the user, which act pulls down the receiver hook.

A MECHANICAL HAND THAT FREES A REAL HAND WHILE 'PHONING

HOUSEHOLD CRANKING TO SAVE COAL

OUT of Germany comes the interesting coal-saving device shown in the accompanying illustration. This development, which has been worked out by Dr. Begas of Berlin, is intended for the economical housewife who is anxious to make her coal supply deliver the last bit of heat which it contains. The ashes from the kitchen range are placed in this sifter, and the device is cranked after the manner of an ice-cream freezer. The ashes are reduced to small pieces and fall down through the screening and into the lower holder, while pieces of good coal are retained in the upper compartment, ready for use. As the device is practically air-tight, no ashes or dust can escape from it to effect an unwelcome decoration of the most immaculate kitchen.



TRICK KITE WHICH LOOPS THE LOOP AND PERFORMS ALL THE WELL-KNOWN AERIAL STUNTS

A FEW MINUTES' CRANKING SALVAGES GOOD COAL FROM THE KITCHEN-RANGE ASHES

BULLET-PROOF GLASS

THERE was recently conducted in New York City a most interesting experiment with what is said to be a bullet-proof glass. A sheet of this glass was subjected to the fire of a .45 caliber automatic pistol at a distance of 12 feet, with the result shown in the accompanying illustration. Although the glass was shattered it stayed in place and resisted the penetrating force of the projectile. The exact nature of the material cannot be divulged at present for obvious reasons.

Great advances have been made in so-called unbreakable glass, the construction of which is in the form of a three-ply sheet of glass and celluloid, the latter being the middle member. Since it is cemented into a solid pane, the glass may shatter in the manner shown in our illustration but it cannot leave the non-shatterable celluloid to which it is firmly cemented. Glass of this kind is extensively employed for eye-protecting goggles, airplane windows, windshields, and other similar uses requiring non-breakable glass. It is probable that the present bullet-resisting glass is another step in the development of such glass, as well as a possible extension of the uses to which it may ultimately be possible to turn this interesting and valuable material.

A KITE THAT LOOPS THE LOOP

AFTER all, kite flying does become monotonous sport in due course. When the kite once leaves the ground and spars alost there is very little excitement to hold the interest of the kite flyer.

With these facts in mind, a skilled mechanic in the employ of one of the leading British aircraft companies has worked out a kite which performs all kinds of aerial stunts. The kite loops the loop, nose dives, side and tail slides, and does all the other stunts usually performed by the most experienced airman. The long tail used in conjunction with the kite, as well as the peculiar shape of the kite proper, serves to make it perform in the manner outlined.

Several attractive offers have already been made to the inventor for the use of his patents, but he insists that only disabled men be employed in the manufacture of these kites.

BULLET-PROOF GLASS AFTER RESISTING .45-CALIBER BULLET AT 12 FEET

A New World Fairy Tale

THE story begins in a little Old World village with an apprentice lad listening to tales told by his elders, in the long evenings after work. As they talked, he learned of a world outside his village, and there came a sudden, half-fearful resolution to break the fetters of his narrow life, and try his fortune in a land of shining opportunity. And so the lad set forth, in his nineteenth year.

Forty-nine days crossing the stormy Atlantic in a sailing vessel; berths of rough boards; food cooked by the passengers themselves—thus in 1849 Jacob Bausch came to America—the land of his dreams. Followed disillusionment, almost complete. An epidemic of cholera in Buffalo; no work to be had; a bare existence as cook's helper and porter in a hotel; then a wood-turner in Rochester, at a dollar a day. And then a venture in his chosen field, the optical business—and utter, disastrous failure and a return to wood turning; and even an accident which threatened his livelihood. And the vision grew dim at times—but still it lived; and again an optical business was attempted, this time in his own house. Henry Lomb joined him, and every hour was busy—yet when Henry Lomb enlisted for the Civil War, their debts just equalled their resources. And this was the net of eight years' work.

Mr. J. J. Bausch at 24 years of age

Mr. Henry Lomb at 26 years of age

But then, slowly, almost imperceptibly, the tide turned. Under the spur of their constant striving for broader knowledge and higher standards, the partners and their sons built up a unique and lasting tradition of science and craftsmanship. Mr. Bausch designed and built the first power lens-grinding machine in America; and gradually other machines and processes were developed, scientific studies undertaken, and new products added to the already well-known eyeglass and spectacle lenses. It took many more years of patient, constructive effort, but success came at last. Exceeding all dreams of the pioneer, the great Bausch & Lomb factory stands as visible evidence of this success.

The best measure is found in the real respect accorded Bausch & Lomb products, wherever science carries on its researches, and wherever imperfect or suffering eyes need aid. The vision of the founders still lives to guide us into pathways of ever broader usefulness.

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New York Chicago San Francisco Washington London

A SEVENTY-MILE HYDRODROME

(Continued from page 535)

taining speed on the water. The submerged planes of the HD-4 are cambered and inclined in accordance with the results of countless experiments, to take advantage of the lifting possibilities of both surfaces.

At present, the hydrofoil surfaces are supporting approximately 2,000 pounds per square foot, at 60 statute miles perhour. Mr. Baldwin says that with the main set of hydrofoils at $1\frac{1}{2}^{0}$ and the rudder horizontal the machine rides on roughly 40 square feet of surface at 20 miles per hour -- a load of 275 pounds per square foot. At 40 miles per hour about 10 square feet of surface carry the load under a strain of 1100 pounds per square foot; at 60 miles the entire machine rides on a surface of about 4 square feet, giving 2470 pounds per square foot of hydrofoil immersed. Whether it would be possible to improve on this showing is pure speculation.

The body of the machine is a torpedo-shaled hull, 60 feet in length, with two outrigger hulls or pontoons, each 16 feet in length and connected with the main hull by a deck. This deck serves also to support the motors, on either side the main hull abreast the cockpit. The deck has to work its passage, for it is in the form of an aerofoil with a flat under surface and cambered top, presenting a useful area of 203 square feet.

The planes or hydrofoils upon which the machine depends for support when under way are arranged in three sets to give a three-point support like that of an iceboat. This obviates the twisting effect always present in a structure supported at four points. To be sure, there is a fourth set of hydrofoils at the bow, but this preventer set, as it is called, is merely to keep the bow from diving. It assists also in lifting the hull out of the water when getting under way, but is entirely clear of the water when the boat is at speed.

Steering is accomplished by pivoting the stern set of

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THE HEAVENS IN DECEMBER

(Continued from page 537)

the motion of the light waves at all. If this is true, it ought to be possible, by suitably designed optical experiments, to detect the motion of the box and its contents in the second case. This would be true, even if the older theory of relativity were accepted, since the box with everything in it are not moving uniformly, but at an ever accelerating rate.

On the other hand it may be that the general principle of relativity applies even here, and that no experiment could detect anything beyond the relative motions of the contents of the box (including the waves of light). Einstein started with this latter assumption -- which necessarily involved the belief that the motion of light is in some way affected by the presence of a gravitational field of force. Following out the consequences through the intricate analysis aforesaid, he reached the conclusion regarding the deflection of rays of light passing near the sun, which has just been so brilliantly confirmed by observation.

Two othernatural phenomena (and only these two, as far as yet is known) should also be necessarily different according to the Einstein theory and the older one. Firstly, the elliptical orbit of a planet should not be quite fixed in space, but its perihelion should slowly advance, by an amount which can be definitely calculated. If there are other planets attracting this one, the perturbations due to their influence must of course be added. Now the perihelion or Mercury, after correction has been made foe the effects of the attraction of

(Continued on page 542)

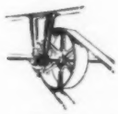
Mill, Mine and Railway Supplies

Trucks and Wheelbarrows

Machine Tools


Scales


Valves


Power Transmission


Engines and Pumps


Automobile and Service Station Equipment

He felt the need of Better Buying

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MACHINE TOOLS - TRUCKS & WHEELBARROWS - ENGINES & PUMPS - AUTOMOBILE AND SERVICE STATION EQUIPMENT

THE HEAVENS IN DECEMBER

(Continued from page 540)

the other planets, is actually moving forward in a manner not explicable by the classical theory, and to an extent about fifty times as great as the probable error of the observations. Now this "inexplicable" advance is found to take place at exactly the rate which has been predicted by Einstein's theory.

Secondly, his theory predicts that all the lines in the solar spectrum should be very slightly shifted towards the red, in comparison with the lines of the same elements, produced in terrestrial laboratories. This effect has been looked for, notably by De St. John at Mount Wilson, and has not been found. There are, however, so many other things that may shift the lines in the sun's spectrum -- pressure, currents in the sun's atmosphere, etc. - that this unfavorable evidence is not so strong as the positive and very favorable evidence of the two phenomena previously discussed.

At the present time, therefore, Einstein's theory appears to be very probable, if not altogether proved. Much is being said about the radical changes in our conceptions which will follow; but it is easy to exaggerate the significance of such remarks.

The central fact which has been proved -- and which is of great interest and importance -- is that the natural phenomena involving gravitation and inertia (such as the motions of the planets) and the phenomena involving electricity and magnetism (including the motion of light) are not independent of one another, but are intimately related, so that both sets of phenomena should be regarded as parts of one vast system, embracing all Nature. The relation of the two is, however, of such a character that it is perceptible only in a very few instances, and then only to refined observations.

The mathematical relations involved are most elegantly, and, to the trained matmematician, most simply expressed in terms of the non-Euclidean geometry, in which the properties of "parallel" lines are not those assumed by Euclid; and of space of four or even five dimensions. But these are only ways of expressing the facts, and ways that are likely to appear simple only to the trained mathematician. The important physical fact is the relation between gravitation and electromagnetism, as explained above.

THE PLANETS - AND THE WEATHER PROPHET

As there is so much news this month, and in view of the exigencies of publication, we will simply refer to out map for the description of the visible constellations, and proceed to speak of the planets.

Here we meet with an example of newspaper notoriety which is utterly without foundation or excuse - the absurd publicity which has been given to the prognostications of a "weather prophet" who predicts that, on or about December 17th. there will be a huge sunspot, accompanied by terrific disturbances on the earth. The alleged reason is that, on this date, six planets will be in conjunction on one side of the sun, with Uranus directly opposite!

There would be no need to speak of such a thing at all in these columns, if it were not that wide publicity has been given the alarmist statement, so that many people have been disquieted. It is hardly necessary to say that there is not the slightest reason for such fancies.

It is true that, about the middle of December, six of the planets will be in conjunction -- if we interpret this term very broadly, since they will be scattered over an arc of longitude of 30°, or one-twelfth of the whole circumference. It is likewise true that Uranus

(Continued on page 543)

THE HEAVENS IN DECEMBER

(Continued from page 542)

is in a longitude opposite a point on this arc which includes the other planets. But there is no reason at all to believe that this chance grouping of the planets, which is rather of a curiosity but not otherwise notable, should have any influence in producing sunspots. These it is now well known are internal disturbances in the sun's atmosphere; and the most careful investigation has failed to detect any evidence of planetary influence in their formation. Moreover, should a sunspot however large appear at this date, or at any other, there is the strongest reason, based on hundreds of previous cases, to believe that it will not have any effect at all on the weather or other earthly phenomena -- barring the aurora borealis, which can hardly be described as a catastrophe.

Mercury is in conjunction with the sun on the 2nd and after this is a morning star, being visible best about the 21st, when he is at elongation, and rises at 5.30 A. M.

Venus too is a morning star, rising at 3.30 A. M. in the middle of the month; and so is Mars, which however rises still earlier at 1 A. M. Jupiter is well past quadrature and rises at 9 P. M. in the middle of the month. He is on the western edge of Leo, while Saturn falls in the eastern part of the same constellation, rising at 11.15 P. M. in the middle of the month.

Uranus is an evening star, setting at 10.30 P. M. on the 1st, and nearly two hours earlier at the end of the month. Neptune is in Cancer and comes to the meridian about 3 A. M.

It will be noticed that though six of the planets are nearly in conjunction with one another, as seen from the sun, about December 15th, the earth is so far out of the line near which they lie that, as viewed by us, they stretch over more than 100° of the ecliptic.

The moon is fullat 5 A. M

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A SEVENTY-MILE HYDRODROME

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hydrofoils about a vertical axis, the struts offering sufficient rudder surface -- just as the struts of the forward set seem to offer sufficient lateral resistance to prevent skidding when turning at high speed.

The planes of all three hydrofoil sets are arranged like the shutter of a Venetian blind, except that they have a slight inclination from the horizontal. It was found in the early experiments, that when they were arranged parallel to the surface of the water, a noticeable irregularity occurred on running in choppy water or changing speed, due to the effect of the entire plane's entering or leaving the water at once. So the lower end of one plane is set about on a level with the upper end of the next below it; and the reefing process when changing speed, or when entering or leaving a wave, becomes smooth and continuous.

The proper angle of incidence for the hydrofoils was a problem decided only after a long series of experiments. It was found that $1\frac{1}{2}^{\circ}$ was the most efficient angle for the forward set, while for the tail set no angle of incidence is needed. For the forward hydrofoils an efficiency of 8 is obtained: that is, the lift obtained is eight times as great as the drift. This is good when compared with hydroplane practice, in which, I believe, the best results are about 6. The high ratio of lift is strikingly evident when under way; for there is never any noticeable retarding effect when running in waves of moderate size. The machine travels with a slight undulation comparable to that of a Pullman car.

The HD-4 originally was powered with 2 Renault motors developing in the neighborhood of 250 H. P. with which a speed of 53.7 miles an hour was obtained. The present motors are a pair of Liberties of the low-compression type, developing 350 H. P. apiece. With these at 1500 R. P. M. a speed of 60 knots has been obtained.

It takes a thrust of about a ton and a speed of about 20 miles an hour to get the hull clear of the water, beyond which point the thrust required drops to 1,500 pounds, rising again very slowly, due principally to the resistance of the air and the reefing of the supporting surfaces. Water resistance drops from 1900 pounds at 15 miles an hour to 1300 at 34 miles an hour, remaining practically constant after this.

The main hydrofoils, on which more than two-thirds the weight of the machine is carried, are placed 15 feet from the bow, and are attached to a heavy steel tube 5½ inches in diameter, which runs transversely through the main and outrigger hulls. Their dihedral angle serves to secure continuity of reefing, and also stability of the machine. When I mustered courage enough to make a sharp turn at something like 60 knots, I was surprised at the total absence of heeling or skidding. When for any reason one side of the machine is depressed, the reserve hydrofoils on that side are brought into play; the faster the speed, the greater the righting effect.

The HD-4 was designed to carry heavy loads at high speed. Her advantages over a flying machine are compactness, ease of operation, ability to reef, and comparative safety. These points are obvious, with the possible exception of the last. Flying is a dull business compared with skimming over the surface of the water at 60 knots, and the degree of safety is not altogether obvious the first time one meets the latter sensation.

There is no reason why a craft of this type could not be built in much larger size. A machine, say, 150 feet in length might be built of steel throughout, and would be of tremendous value to the Navy for carrying torpedoes and the like. Structural problems decrease as the size goes up. The limiting factor is the power plant; but even now larger units of the Liberty type are under construction.

THE HEAVENS IN DECEMBER

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on the 7th, in her last quarter at 1 A. M. on the 14th, new at 6 A. M. on the 22nd, and full at midnight on the 29th. She is nearest us on the 7th, and farthest away on the 20th. During the month, she is in conjunction with Neptune and Jupiter on the 11th, Saturn on the 13th, Mars on the 15th, Venus on the 18th, Mercury on the 20th, and Uranus on the 27th. The conjunction with Mercury is fairly close.

COMETS

Two more comets have been discovered since the last of these articles was written: one by Sasaki at Kyoto on October 25th, and the other by Schaumasse, in France, on October 29th. The former was near the star Psi Capricorni at the time of discovery, but on November 9th -- the only other observation at hand so far, it was in 22^h27^m R. A., and $13°23'$ south declination - having moved eastward and nearly parallel to the eclitpic, fully 25° in the fifteen days. This indicates that it must be fairly near us, and that the inclination of its orbit plane is probably small; but beyond this nothing can be said about its orbit. It is west of the sun and moving away from it, so that it should be easily observable in the evening sky, crossing the meridian after dark. It is visible in a small telescope, but not with the naked eye.

Schaumasse's comet turns out to be a return of Finlay's comet, a well known visitor first observed in 1886, and having the short period of 6 2/3 years.

Metcalf's two comets are also still in sight. The identity of the first with Brorsen's comet is now confirmed. Certain Danish computers gave thought it to be probable that its period is 36 years, and that it has made two revolutions since 1847; but Prof. Leuschner of the University of California at the meeting of the National Academy of Sciences this week, presented very conclusive arguments in favor of the period of

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THE HEAVENS IN DECEMBER

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72 years. Metcalf's second comet appears to have a smaller perihelion distance than indicated by the earlier computations - about 100 million miles; but otherwise its orbit is much as described last month.

CONCRETE CONSTRUCTION ON THE MISSISSIPPI SANDS

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entire sand fill was being washed away, before the construction could begin. Three nozzles, each having a water power of sixty pounds, were being handled by two negroes each; and the engineer in charge estimated that 1000 cubic yards were being washed away each day. The terraced arrangement of the creosoted pine planks was exposed to view, driven in clusters of fifteen, twenty feet either way. Then these piles are cut off below low-water mark, which is 21 feet, Cairo datum. The untreated pine pile, under these conditions, is virtually everlasting. It is used at New Orleans in all concrete construction that extends below the low-water mark.

After they are cut off at the above-mentioned measurement, the "21-cut-off," the piles are capped; and then reinforced concrete columns are run up to the first story of the warehouse, at about five feet above highest water, or 41 feet Cairo datum. The first floor of the wharf supports a load of 500 pounds per square foot; the second floor holds 350 pounds per square foot.

Between the concrete columns forming the foundation of the wharfhouse may be seen, in the photographs, a series of X-braces also of concrete, which distribute the load evenly. This job, done in ten weeks, is ore of the attractive and unique features og the construction. The apron in front of the warehouse is made entirely of creosoted blocks across which two railroad tracks run. It is supported by creosoted pine piles, from 90 feet long at the front edge to 75 feet at the rear.

The pictures illustrating this article show the construction of the wharfhouse, with parts of the construction of one of the crossings leading back from it to the warehouse proper. This crossing like all the other finished pavements is thoroughly reinforced to prevent sinking, and finished with a hard flinty trap-rock that is brought at considerable expense from Texas.

From the concrete cappings seen in the picture of the paved walk, concrete columns are run up to an overhead covering, which forms the floor of another crossing or runway. The lower runway is at the level of the first floor of the warehouse; the upper one at the second story level. On these runways cotton is moved to and fro by means of motor trucks and trailers.

The pictures are interesting enough, but they can give no conception of the beauty that absorbed the attention of the writer on the spring afternoon when these scenes were going forward. The Mississippi was flowing lazily to the Gulf, highly burnished under the hot sun. Hundreds of negroes moved over the tops of the wooden structures which are to be seen in the photographs. A tiny object -- another negro -- stood on the very top of the curious concrete tower, ready to shoot the mixture down wherever it was needed. And hundreds of these same workers moved over the ground with little twowheeled carts full of stones and cement to be mixed.

The sound of a crowd of negro workmen spread otself over everything: that heavy, droning minor note that always accompanies their labor. The river shone coppery; the sun beat down hotter; the land seemed very flat: it might have been Egypt and the Nile. And a strangely pervading atmosphere of antiquity seemed suddenly to link up this ultra-modern project with the achievements of those by-gone peoples, who also lived at the gateway of a great continent.

"Jason you must tame two brazen-footed, brazen-lunged bulls wrought by Vulcan before you can win the Golden Fleece" quoth Æetes, King of Colchis, to the intrepid leader of the Argonauts. "After taming the fiery bulls you must yoke them to a plow and must plow the sacred earth in the grove of Mars, and sow some of the dragon's teeth from which Cadmus raised a crop of armed men."

How Jason aided by Medea, fair daughter of Æetes "took the bulls by the horns" made their brute strength subservient to his will, harnessed them and plowed the field and won the Golden Fleece, is told by Homer in the Odyssey.

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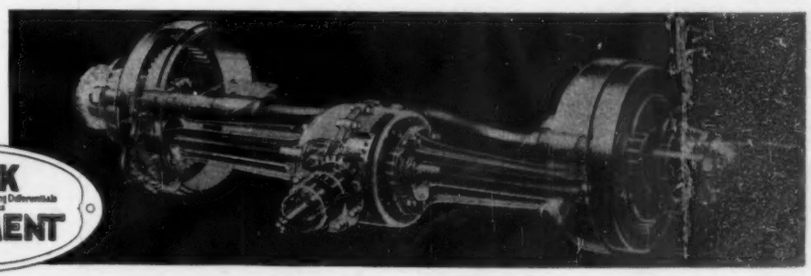

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